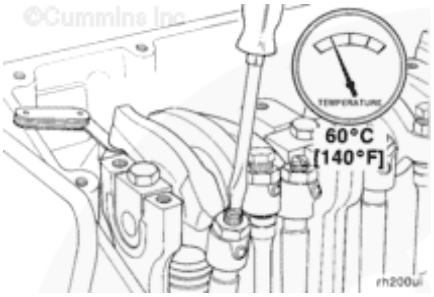
Overhead Set
(003-004)

Measure

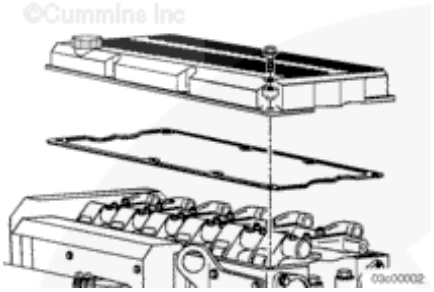
General Information

All overhead lash measurements **must** be made when the engine is cold. Stabilized coolant temperature **must** be at 60°C [140°F] or below.



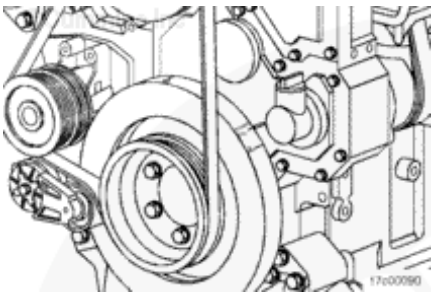
Remove the rocker lever cover.

Make sure the engine base timing is properly set before attempting to measure, adjust, or set the overhead.



Early engine vibration dampers are marked with BRAKE SET 1-6, BRAKE SET 2-5, or BRAKE SET 3-4. The engine brakes **must** be set at the appropriate mark on these engines. Newer engine vibration dampers are marked with **only** A, B, or C, and are adjusted with the valves and injector on the same cylinder.

Locate the valve set marks on the outside of the vibration damper.



The set marks are A, B, and C:

Set to mark A to adjust cylinder 1 or 6.
Set to mark B to adjust cylinder 2 or 5.
Set to mark C to adjust cylinder 3 or 4.

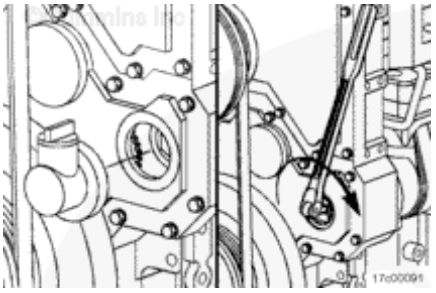
Two complete revolutions are required to set all valves, engine brakes, and injectors.

If the engine is equipped with an air compressor:

Remove the oil fill connector from the lower gear case cover.

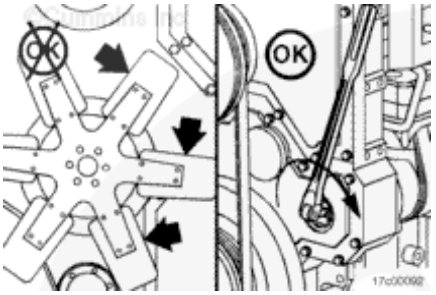
Insert a 3/4-inch drive ratchet and extension into the air compressor drive.

Rotate the air compressor drive **clockwise**, as viewed from the front of the engine.



WARNING

Do not pull or pry on the fan to manually rotate the engine. To do so can damage the fan blades. Damaged fan blades can cause premature fan failures which can result in serious personal injury or property damage.



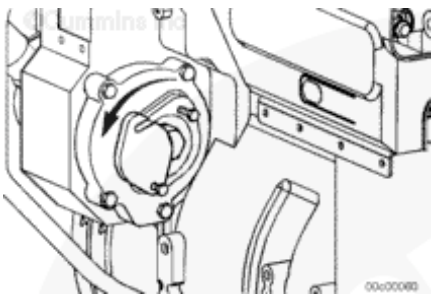
The crankshaft rotation is **clockwise**, as viewed from the front of the engine.

The cylinders are numbered from the front of the engine (1-2-3-4-5-6).

The engine firing order is 1-5-3-6-2-4.

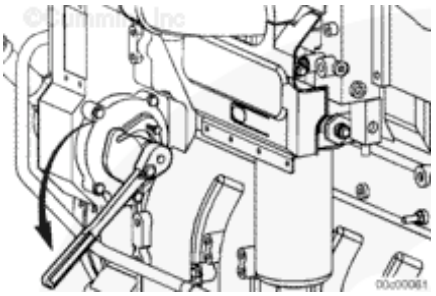
If the engine is **not** equipped with an air compressor:

Loosen the cover plate capscrews and rotate the cover or remove the oil fill tube, if equipped.



Use a 1½ inch socket to push the barring gear into the gear mesh and rotate the barring adapter **counterclockwise** to bar the engine.

Rock the barring device back and forth until it disengages.



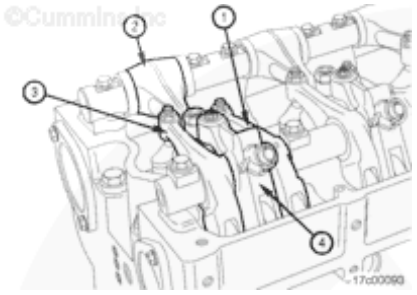
Each cylinder has four rocker levers:

- The exhaust valve rocker lever (1)
- The injector rocker lever (2)
- The intake valve rocker lever (3)
- The engine brake rocker lever (4).

The intake valve rocker lever is **always** the long lever on the valve rocker lever shaft.

Early engine vibration dampers are marked with BRAKE SET 1-6, BRAKE SET 2-5, or BRAKE SET 3-4. The engine brakes **must** be set at the appropriate mark on these engines. Newer engine vibration dampers are marked with **only** A, B, or C, and are adjusted with the valves and injector on the same cylinder.

The valves, brakes, and the injectors on the same cylinder are adjusted at the same index mark on the vibration damper.

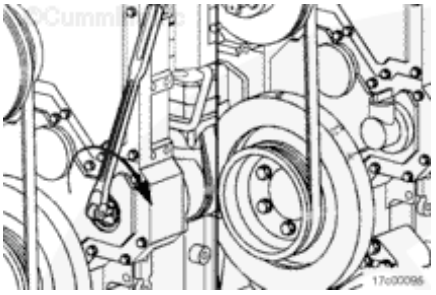


Injector and Valve Adjustment Sequence				
Bar Engine in Direction of Rotation	Pulley Position	Set Cylinder Injector	Set Cylinder Valve	Set Cylinder Brake
Start	A	1	1	1
Advance to	B	5	5	5
Advance to	C	3	3	3
Advance to	A	6	6	6
Advance to	B	2	2	2
Advance to	C	4	4	4

Firing Order: 1-5-3-6-2-4

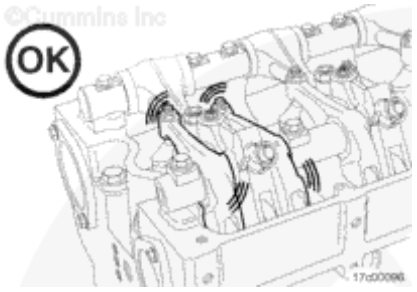
NOTE: For illustrative purposes, position A is shown as the first step. It is not necessary to start with position A, as long as the proper sequence is followed.

Use the compressor drive or barring device to bar the engine over in the direction of engine rotation, **clockwise** as viewed from the front of the engine. Align the A mark on the vibration damper with the pointer on the gear cover.



Check the valve rocker levers on the given cylinder to see if both intake and exhaust valves are closed.

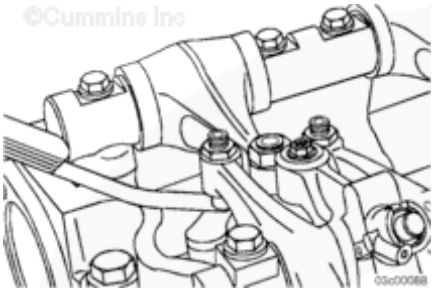
Both sets of valves are closed when the rocker levers and the brake lever are loose. If both sets of valves are **not** closed, rotate the compressor drive gear one complete revolution, and align the A mark on the front damper with the pointer again.



Valve Lash

Use feeler gauges to measure the amount of clearance (lash) between the crosshead and the rocker lever nose. Measure and record the intake, exhaust, and brake valve lash. If the valve lash is **not** within the specifications listed below, the valve **must** be adjusted. See the adjust step in this procedure.

Press the brake lever down to verify the camshaft follower is in contact with the camshaft prior to measurement of the brake lash.



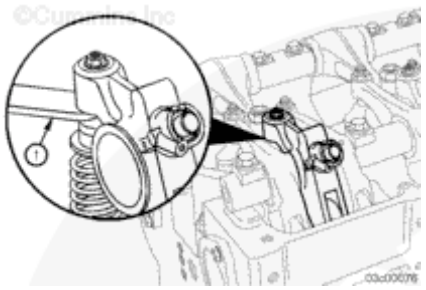
ISX, QSX Series Valve Lash Recheck Limits			
Intake	0.23 mm	minimum	0.006 in
Intake	0.48 mm	maximum	0.019 in
Exhaust	0.56 mm	minimum	0.022 in
Exhaust	0.81 mm	maximum	0.032 in
Brake	6.87 mm	minimum	0.271 in

Brake	7.13 mm	maximum	0.281 in

Brake Running Clearance

Rotate the brake lever to the detent (neutral) position. Check the clearance between the engine brake actuator piston and the cross head guide pin (1). If the brake running clearance is **not** within the specifications listed below, the running clearance **must** be adjusted. See the Adjust step in this procedure.

Brake Running Clearance		
mm		in
0.635	MIN	0.025
2.79	MAX	0.110



Injector Lash

There is no service procedure to check the injector free load.

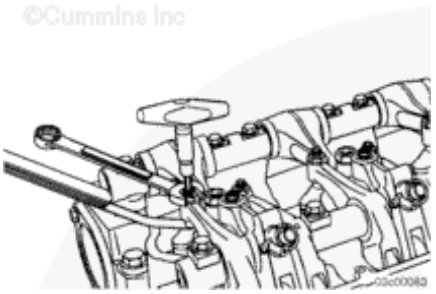
Install the rocker lever cover.

Adjust

Read the entire procedure for overhead adjustment before attempting to perform this operation.

Valves, injectors, and engine brakes (if equipped) **must** be correctly adjusted for the engine to operate efficiently. Valve, injector, and engine brake adjustment **must** be performed using the values listed in this section.

After an engine rebuild or any major repair where the injector and valve setting **must** be disturbed, set all of the valves, injectors, and brakes.



Valve, Brake, and Injector Adjustment Values	
Injector Adjustment is 8 N·m [70 in-lb]	
Intake Valve	0.35 mm [0.014 in]

Exhaust Valve	0.68 mm [0.027 in]
Engine Brake	7.00 mm [0.276 in]

Early engine vibration dampers are marked with BRAKE SET 1-6, BRAKE SET 2-5, or BRAKE SET 3-4. The engine brakes **must** be set at the appropriate mark on these engines. Newer engine vibration dampers are marked with **only** A, B, or C, and are adjusted with the valves and injector on the same cylinder.

Locate the valve set marks on the outside of the vibration damper.

The set marks are A, B, and C:

Set to mark A to adjust cylinder 1 or 6.
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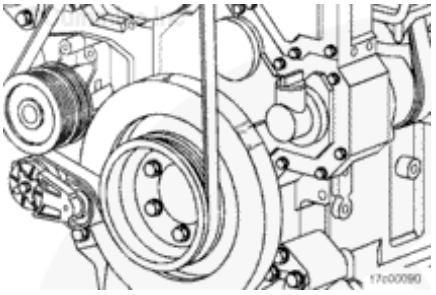
Two complete revolutions are required to set all valves, engine brakes, and injectors.

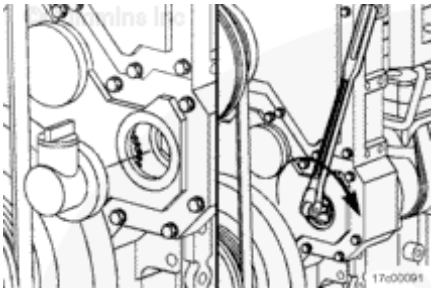


If the engine is equipped with an air compressor:

Remove the oil fill connector from the lower gear case cover.

Insert a 3/4-inch drive ratchet and extension into the air compressor drive.

Rotate the air compressor drive **clockwise**, as viewed from the front of the engine.



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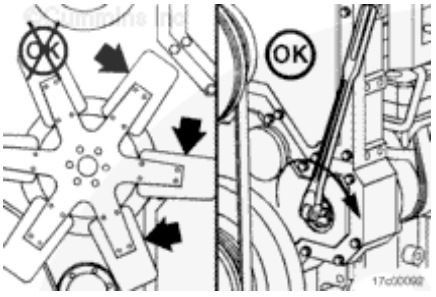

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The cylinders are numbered from the front of the

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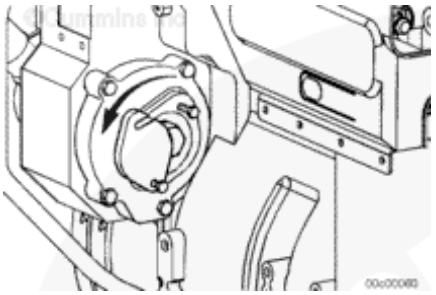
The engine firing order is 1-5-3-6-2-4.

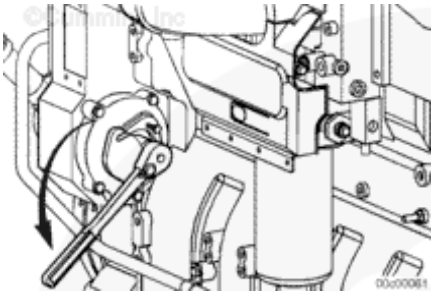
If the engine is **not** equipped with an air compressor:

Loosen the capscrews and rotate the cover or remove the oil fill tube, if equipped.



Use a 1½ inch socket to push the barring gear into the gear mesh and rotate the barring adapter **counterclockwise** to bar the engine.

Rock the barring device back and forth until it disengages.



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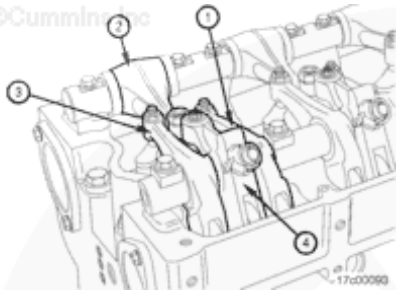
The valves, brakes, and injectors on the same cylinder are adjusted at the same index mark on the vibration damper.

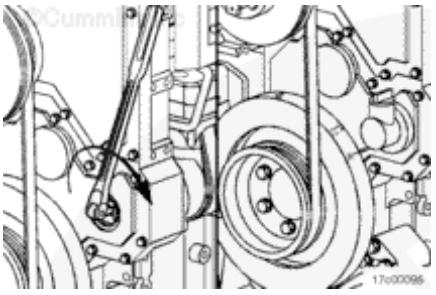


Injector

and Valve Adjustment Sequence				
Bar Engine in Direction of Rotation	Pulley Position	Set Cylinder Injector	Set Cylinder Valve	Set Cylinder Brake
Start	A	1	1	1
Advance to	B	5	5	5
Advance to	C	3	3	3
Advance to	A	6	6	6
Advance to	B	2	2	2
Advance to	C	4	4	4
Firing Order: 1-5-3-6-2-4				

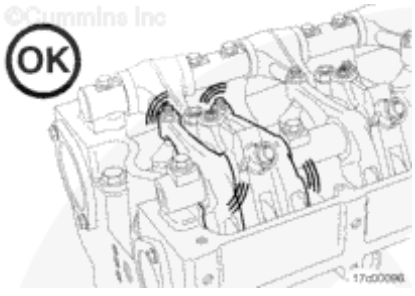
NOTE: For illustrative purposes, position A is shown as the first step. It is not necessary to start with position A, as long as the proper sequence is followed.

Use the compressor drive or barring device to bar the engine over in the direction of engine rotation, **clockwise** as viewed from the front of the engine. Align the A mark on the vibration damper with the pointer on the gear cover.



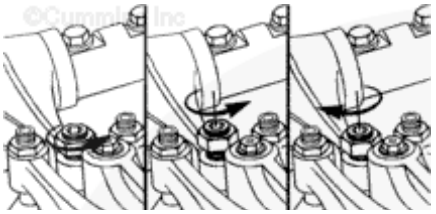
Check the valve rocker levers on the given cylinder to see if both intake and exhaust valves are closed.

Both sets of valves are closed when the rocker levers and the brake lever are loose. If both sets of valves are **not** closed, rotate the compressor drive gear one complete revolution, and align the A mark on the front damper with the pointer again.



Loosen the injector adjusting screw locknut on the cylinder.

Do **not** use a click-type torque wrench.



Use a dial-type torque wrench with a range of 0 to 150 in-lb to tighten the injector rocker lever adjusting screw. If the screw chatters during setting, repair the screw and lever as required.

Back out the adjusting screw one or two turns.

Hold the torque wrench in a position that allows you to look in a direct line at the dial. This is to make sure the dial will be read accurately.

Make sure the parts are aligned, and squeeze the oil out of the valve and injector train by tightening the adjusting screw.

Use this initial adjustment to preload the valve train and injector.

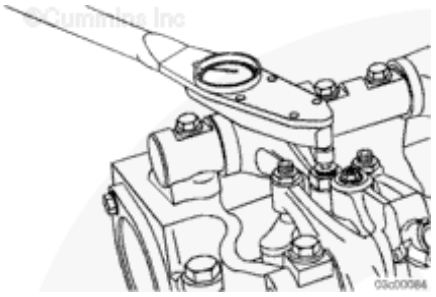
Tighten the injector lever adjusting screw.

Torque Value:	8 n.m	[71 in-lb]

Back the adjusting lever screw out 1 or 2 turns.

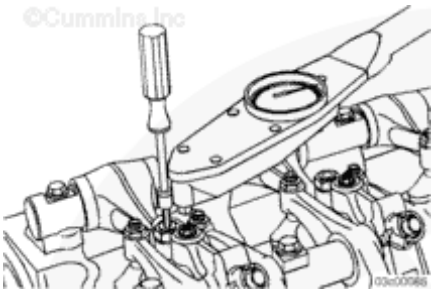
Tighten the injector lever adjusting screw.

Torque Value:	8 n.m	[71 in-lb]



Hold the injector lever adjusting screw and tighten the adjusting screw locknut.

Torque Value:	75 n.m	[55 ft-lb]



After setting the injector on a cylinder, set the valves and engine brakes on the same cylinder.

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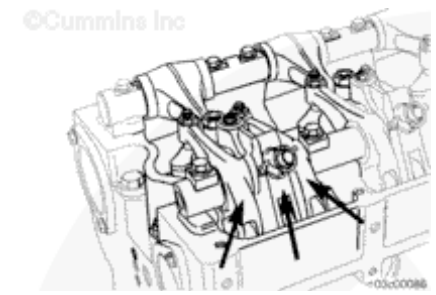
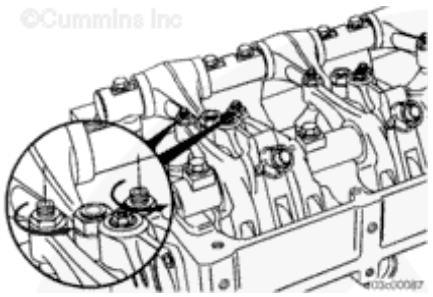


dampers are marked with **only** A, B, or C, and are adjusted with the valve and injector on the same cylinder.

With the set mark aligned with the pointer on the gear cover and both sets of valves closed on the cylinder, loosen the locknuts on the intake and exhaust valve adjusting screws.

Back out the adjusting screws one or two turns.

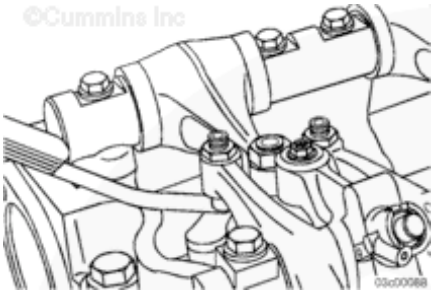


Select a feeler gauge for the correct valve lash specification.

Valve Lash Specification			
	mm		in
Intake	0.36	NOM	0.014
Exhaust	0.69	NOM	0.027

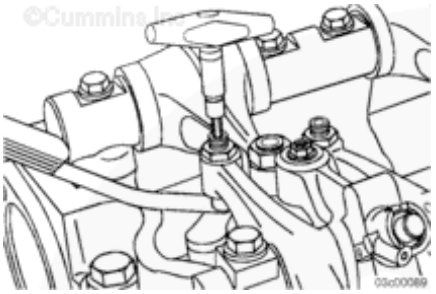
Insert the feeler gauge between the top of the crosshead and the rocker lever nose pad.

Make sure the feeler gauge is completely under the pivoting rocker lever nose pad.



Tighten the adjusting screw.

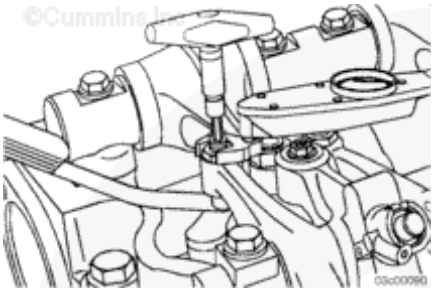
Torque Value:	0.6 n.m	[5 in-lb]



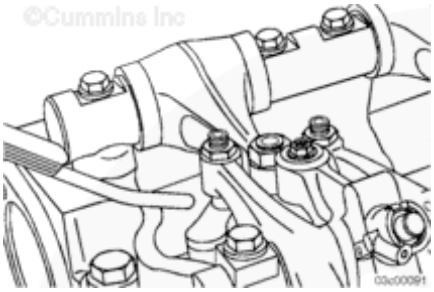
Use a torque wrench and crows foot adapter to tighten the locknut.

Hold the adjusting screw in this position. The adjusting screw **must not** turn when the locknut is tightened.

Torque Value:	45 n.m	[33 ft-lb]

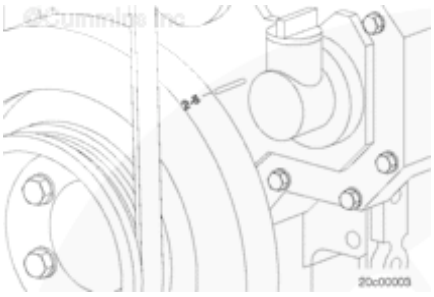


After tightening the locknut to the correct torque value, remove the feeler gauge.



CAUTION

To get maximum brake operating efficiency and to prevent engine damage, the brake adjustment instructions must be followed.



For older engines, locate the engine brake set marks on the outside of the vibration damper.

The set marks are BRAKE SET 1-6, and BRAKE SET 2-5, and BRAKE SET 3-4.

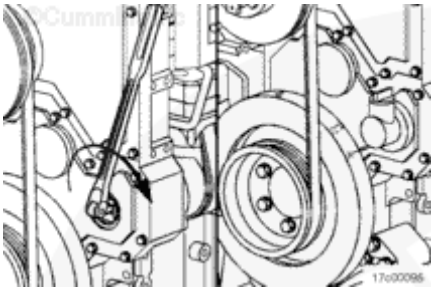
BRAKE SET 1-6: Cylinder 1 or 6 adjust

BRAKE SET 2-5: Cylinder 2 or 5 adjust

BRAKE SET 3-4: Cylinder 3 or 4 adjust

Use the compressor drive or barring device to bar the engine over in the direction of rotation, **clockwise** as viewed from the front of the engine. Align the A mark on the vibration damper with the pointer on the gear cover.

For illustrative purposes, position A is shown as the first step. It is **not** necessary to start with position A, as long as the proper sequence is followed.



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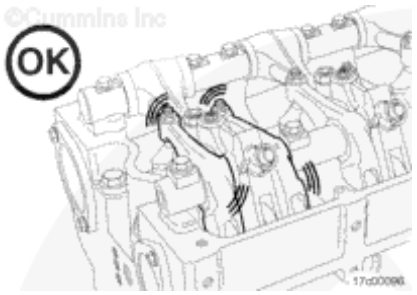
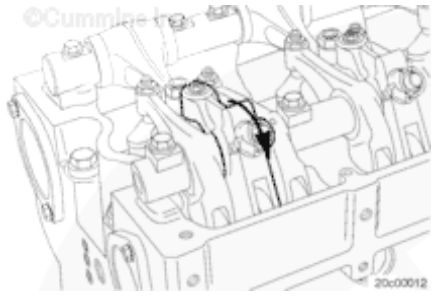
Both sets of valves are closed when the rocker levers and the brake lever are loose. If both sets of valves are **not** closed, rotate the compressor drive gear one complete revolution, and align the A mark on the front damper with the pointer again.



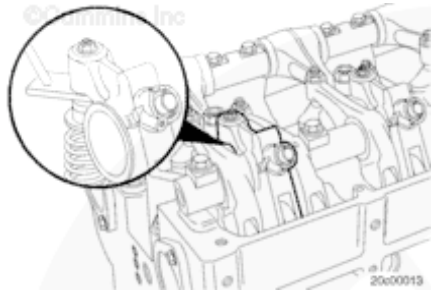
Press the engine brake lever down to verify the camshaft follower is in contact with the camshaft.



Loosen the locknut on the brake lever adjusting screw, and back out the adjusting screw one turn.

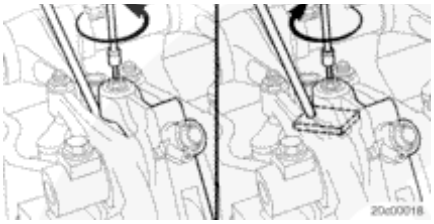
Insert the feeler gauge, Part Number 3163530, between the bottom of the engine brake piston and the top of the exhaust valve pin on the exhaust valve crosshead.

Brake Lever Lash Specification		
mm		in
7.00	NOM	0.276



Tighten the adjusting screw until drag on the feeler

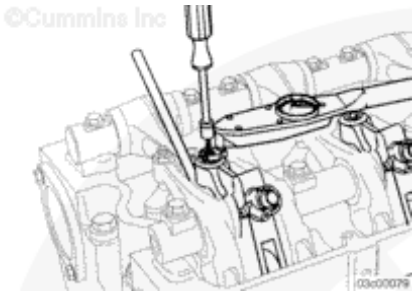
gauge is felt. Proper drag means that there is no motion of the brake lever camshaft follower against the cam lobe.



Hold the engine brake lever adjusting screw and tighten the locknut.

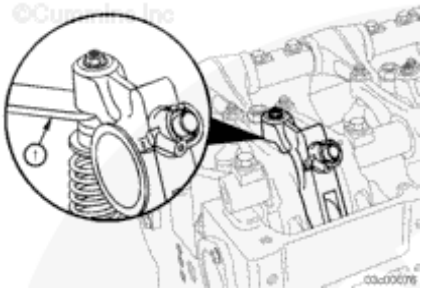
Torque Value:	20 n.m	[177 in-lb]

Remove the feeler gauge.



CAUTION

Engine damage can occur if the running clearance is not within specifications.



Check the running clearance:

0. Rotate the engine brake rocker lever to the detente (neutral) position.
1. Check the clearance (1) between the engine brake lever actuator piston and the crosshead guide pin.

Engine Brake Rocker Lever Running Clearance		
mm		in
0.635	MIN	0.025
2.790	MAX	0.110

If the running clearance does **not** meet specification, loosen, but do **not** remove the rocker shaft capscrews, and rotate the shaft in the direction required to bring the running clearance within the listed specification. It is critical that this clearance be set and verified on all six brake levers. Engine damage can result if this task is **not** completed.

Check the brake running clearance.

The rocker lever shafts **must** be adjusted so that all three engine brake levers fall within the given running clearance specification.

Repeat the process to adjust all injectors, engine brakes, and valves according to the chart shown below.

Injector and Valve Adjustment Sequence

Bar Engine in Direction of Rotation	Pulley Position	Set Cylinder Injector	Set Cylinder Valve	Set Cylinder Brake
Start	A	1	1	1
Advance to	B	5	5	5
Advance to	C	3	3	3
Advance to	A	6	6	6
Advance to	B	2	2	2
Advance to	C	4	4	4

Firing Order: 1-5-3-6-2-4

Last Modified: 28-Apr-2008